

AMENDMENT
S/N 09/783,179, FILED 02/12/01

PATENT
226-133

LISTING OF CLAIMS

1. (canceled)

2. (canceled)

3. (canceled)

4. (canceled)

5. (canceled)

6. (canceled)

7. (canceled)

8. (cancelled)

9. (canceled)

10. (canceled)

11. (canceled)

12. (canceled)

13. (cancelled)

14. (canceled)

15. (canceled)

16. (canceled)

17. (withdrawn) A fixture for magnetizing axially alternating N and S poles defined circumferentially in a portion of an outer periphery of an axially extending, cylindrical, smooth shaft, said fixture comprising:

- (a) a hollow cylindrical mandrel formed from a non-magnetic, non-electrically-conducting material;
- (b) a conductive wire disposed in parallel, circumferential channels defined in an outer surface of said mandrel;
- (c) a potting compound surrounding said mandrel to secure said conductive wire in place; and
- (d) a central bore defined axially and centrally through said mandrel and exposing or nearly exposing said conductive wire; and
- (e) said central bore being sized to accept axially inserted therein said portion of said axially extending, cylindrical, smooth shaft.

18. (withdrawn) A fixture, as defined in Claim 17, wherein: said conductive wire is placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

19. (withdrawn) A method of providing axially alternating N and S poles in a portion of an axially extending, cylindrical, smooth shaft for a linear stepper motor, comprising:

- (a) providing a magnetizing fixture comprising: a hollow cylindrical mandrel formed from a non-magnetic material; a conductive wire disposed in parallel, circumferential channels defined in an outer surface of said mandrel; a

potting compound surrounding said mandrel to secure said conductive wire in place; and a central bore defined axially and centrally through said mandrel and exposing or nearly exposing said conductive wire; and said central bore being sized to accept axially inserted therein said portion of said axially extending, cylindrical, smooth shaft;

(b) inserting said portion of said axially extending, cylindrical shaft in said central bore; and

(c) providing a direct current through said conductive wire said conductive wire is placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

20. (withdrawn) A method, as defined in Claim 19, further comprising: providing said conductive wire placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

21. (withdrawn) A method of manufacturing a magnetizing fixture for magnetizing axially alternating N and S poles defined circumferentially in a portion of an outer periphery of an axially extending, cylindrical, smooth shaft, said method comprising:

(a) providing a plurality of parallel, circumferential channels defined in an outer surface of a cylindrical mandrel formed from a non-magnetic material;

(b) placing a conductive wire in said parallel, circumferential channels;

(c) providing a potting compound surrounding said mandrel to secure said conductive wire in place;

(d) forming a central bore defined axially and centrally through said mandrel and exposing or nearly exposing said conductive wire; and

(e) said central bore being sized to accept axially inserted therein said

portion of said axially extending, cylindrical, smooth shaft.

22. (withdrawn) A method, as defined in Claim 21, further comprising:
providing said conductive wire placed in said parallel, circumferential channels such that direction of flow in said conductive wire of a direct current in adjacent ones of said parallel, circumferential channels is in opposite directions.

23. (currently amended) A linear stepper motor, comprising:

(a) an annular stator structure;

(b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure;

(c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft;

(d) said portion of said axially extending, cylindrical, permanent magnet shaft has a solid core; ~~and~~

(e) said solid core is formed from a non-magnetic material; and

(f) said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

24. (previously presented) A linear stepper motor, comprising;

- (a) an annular stator structure;
- (b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure;
- (c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft; and
- (d) said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

25. (canceled)

26. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.

27. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.

28. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor is constructed to operate in any orientation.

29. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.

30. (previously presented) A linear stepper motor as defined in Claim 23, wherein: said stator structure has conventionally wound coils.

31. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor includes no lead screw and no ball screw.

32. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.

33. (previously presented) A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.

34. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said portion of said axially extending, cylindrical, permanent magnet shaft is hollow.

35. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.

36. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.

37. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor is constructed to operate in any orientation.

38. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.

39. (previously presented) A linear stepper motor as defined in Claim 24, wherein: said stator structure has conventionally wound coils.

40. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor includes no lead screw and no ball screw.

41. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.

42. (previously presented) A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.